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ABSTRACT

Judged by its results, the current system for educating African American students in mathematics is a distinct failure. For years, educators either ignored this problem or simply blamed the failure of the system on its victims. In 1984 the Journal for Research in Mathematics Education drew national attention to the problem by devoting an entire issue to articles and reviews of available research on how America's ethnic minorities learn and perform in mathematics. For the present paper, 24 research studies reported since 1984 and involving African American students were reviewed, and several parent-, student-, and school-related factors that might influence performance and participation in mathematics were identified. Following up on that work, this paper reviews studies that have been done on this subject since 1984. Most were correlational studies. (Author/MKR)

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Mathematics Education Research on Minorities from 1984 to 1994: Focus on African American Students

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MATHEMATICS EDUCATION RESEARCH ON MINORITIES FROM 1984 TO 1994: FOCUS ON AFRICAN AMERICAN STUDENTS

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Judged by its results, the current system for educating African American students in mathematics is a distinct failure. For years, educators either ignored this problem or simply blamed the failure of the system on its victims. Eleven years ago, the Journal for Research in Mathematics Education drew national attention to the problem by devoting an entire issue to articles and reviews of available research on how America's ethnic minorities learn, and perform in mathematics. Twenty-four studies involving African American students were reviewed, and several factors that might influence performance and participation in mathematics, identified. Following up on that work, this paper reviews studies that have been done on this subject since 1984. Most were correlational studies.

Why are African Americans (blacks) so seriously underrepresented in mathematics? What causes the persistent under-achievement of black students in this subject? How can schools rectify the gross racial inequity in mathematics education outcomes? These and similar questions have been begging for answers for decades. The Journal for Research in Mathematics Education (JRME) drew attention to this neglected problem when, in 1984, it devoted an entire issue to research on factors which influence how America's ethnic minorities, including blacks, learn and participate in mathematics (Matthews, 1984). This paper is a follow-up to that seminal work. Its purpose was to review some of the research that had been done on this subject since 1984, and give ideas that may guide further research in the area. Only studies involving black students were considered.

Selection of Research Studies. Because of space limitations, studies reviewed for this paper were identified from lists of mathematics education research which appeared in July issues of the JRME from 1984 to 1994. Only a few of these studies were cited. Items were selected for their potential to contribute to our meager knowledge base on the subject of blacks and mathematics. Some of the studies focused exclusively on black students; most included a significant number of black students in their samples.

Framework for this Review

Matthews' (1984) review identified several parent-, student-, and school-related factors thought to influence the quality as well as the outcomes of the mathematics education of minority students. These factors were classified into three groups, and presented as in Table 1. No claim was made about the comprehensiveness of the list of factors. At the time of this initial review, there was very little empirical evidence linking some of the variables to the mathematics performance of black students. However, Matthews' framework was used for the current review because of its logical structure and because it was sufficient to accommodate all the factors that were cited in the studies reviewed.

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Table 1
Parent, Student, and School Factors That Affect the Performance and Participation of African Americans in Mathematics

Parent	Student	School
Ascribed Characteristics race, sex, age *Cognitive* past and present education & occupation *Affective* expectations and aspirations for child; support for mathematics performance. *Cultural* communication style, primary language spoken at home	*Ascribed Characteristics* race, sex, age *Cognitive* past and present mathematics performance and enrollment *Affective* achievement orientation, self-concept, locus of control, stereotyping, perceived utility of mathematics *Cultural* cognitive learning style, language proficiency	*Climate* discipline, attendance *Organization* course offerings, sequence and prerequisites, curriculum placement, class size *Resources* facilities, materials *Personnel* ascribed characteristics, professionalism, instructional methods, attitudes and perceptions, student interaction.

Parental Influences On Mathematical Achievement

A search of the literature turned up no study of the effects of parents' ascribed or cultural characteristics on student performance in mathematics. However, the effects of cognitive and socioeconomic factors were examined in several studies. Most of these studies found parental occupation, income and education to be positively correlated to children's mathematical achievement (Blackwell, 1984). One study (Kaaya, 1989) found no such relationship.

Many mathematics educators believe that high but realistic expectations can exert a positive influence on mathematical achievement. Researchers who explored this issue in black student populations found supporting evidence for the belief (Kaaya, 1990; Rhone, 1990). The two studies also suggest that the educational and vocational aspirations which black parents have for their children can predict how well these students will do in mathematics. It appears that parental expectations communicate to children in a very powerful way how much their parents *believe* in them. This, in turn, strengthens the children's *belief* in themselves.

Other correlates of improved mathematical performance among black students are success-related behaviors of parents such as developing partnerships with

their children's schools, having positive attitudes towards mathematics, engaging in mathematics-related activities with their children, scheduling homework routines and making sure that children get help with schoolwork when necessary.

Student Factors

It is widely accepted that the characteristics which a learner brings to any learning situation will affect the outcome of the event. In the past, scholarly discourse on differential achievement in mathematics often centered on the minority student's race, risk factors and assumed cultural deficits. During the past ten years, however, the research focus appears to have shifted to the student's cognitive, affective and unique cultural characteristics.

Reyes' (1984) review of the literature on affective variables showed a consistent pattern of strong, positive correlations between self concept of mathematical ability and achievement in the subject. Similar results were obtained from studies of black students ranging from elementary grades through college (Groman, 1989; House, 1993). Groman's study further showed that measures of academic self-concept could be used to predict the number of mathematics courses female black students might take in the future. It seems that self-confidence is very influential in decisions black students make concerning their mathematics education.

The concept of cognitive style recently emerged as a means of explaining some of the persistent racial differences in mathematics performance and participation. Hale-Benson (1986), for example, argued that most African American students process information in ways that are very different from those of whites. According to this perspective, black students tend to be field-dependent, intuitive rather than analytical, holistic and people oriented; they have relational learning styles which differ from the analytic styles that schools prize. As a result, racial disparities in academic achievement may be partly due to the failure of schools to appreciate and adapt to the unique characteristics of African American learners. These claims have, so far, received only limited support from studies of attributional and learning style preferences of African American students.

The results of some recent studies indicate that many black students have affective profiles similar to what Hale-Benson described (Rech, 1991) . The black students in these studies tended to have an external locus of control, and be field-dependent—a trait generally associated with low mathematics achievement. However, other studies found no significant positive correlation between mathematics achievement and these traits. In fact, the data from one study flatly contradict the claim that black students are predominantly holistic (Roberts, 1991). There is clearly a need for more research in this area.

School Factors

There is no question that, in general, black students under achieve in school mathematics. They are subject to more disciplinary measures, and are labeled as slow learners in disproportionately large numbers. What has always been at issue is whether schools contribute to the learning problems which these students have,

and if so, how. Findings from some studies suggest that school policies such as tracking and grade retention are detrimental to black students. The common practice of tracking and putting academic labels particularly on black students is supposedly based on objective scientific measures. Yet, Johnson (1986), found that racial and socioeconomic considerations strongly influence and contaminate the process. Academic tracking is often denounced, with justification, because bright black students are sometimes mislabeled, and because the classification creates lower expectations of the students involved. There is some indication, however, that factors other than the mere act of tracking itself may be responsible for the plight of academically tracked black students. The results of a study involving black students in 8th grade found no effect due to ability grouping, on the mathematical performance of these students (Meeks, 1994).

Like tracking, grade retention and emphasis on discipline may be counterproductive school practices. It seems quite reasonable not to promote a student until basic essential knowledge for his or her current grade has been acquired. Moreover, school effectiveness research recommends that schools maintain safe and orderly learning environments. Nevertheless, grade retention and an undue focus on discipline tend to correlate with low mathematics performance by affected black students.

School climate and social structure also seem to influence how black students perform in mathematics. Where classroom tension is high, differential mathematics achievement between black and white students tends to be high; where cohesiveness and satisfaction prevail, achievement differences between the races tend to be small (Deng, 1992) . Furthermore, hostile school environments alienate black parents and prevent the development of beneficial parent-school partnerships.

Studies of the effect of expectations, reviewed earlier in this paper, point to a strong link between mathematics performance and achievement-related expectancies of students and parents . Teacher expectations also appear to have a strong impact on the performance and participation of black students in mathematics.

To begin with, there is some evidence that teachers' expectations are influenced by student characteristics. Unfortunately, teachers seem to value qualities of obedience, dependence, and conformity rather than assertiveness and independence in black students. Although there is no measure of the power of teacher expectations, its strength is indicated by the finding that the mere perception of high teacher expectations evokes in black students greater task orientation and performance.

Curriculum and Instruction also turn out to be strong factors in the mathematical performance of black students. Variables found to have a positive effect on performance include early intervention with culturally relevant curriculum materials, and the use of problem solving and constructivist instructional strategies. Cooperative Learning structures benefit some, but not all, black students; Computer Assisted Instruction can improve performance by low achievers. However, remedial strategies which are used with students in lower mathematics tracks correlate only with poor performance .

Concluding Remarks

Research on the mathematics education of African Americans has taken a turn for the better. For one thing, the research is being done with black children, and increasingly by people with a direct experience of some of the issues involved. For another, theoretical underpinnings of the studies, where they exist, are shifting from those that view the unique characteristics of black children as deficits, disadvantages, and pathologies to those that see the educational problems of these children primarily as issues of inequity. The research is clearly in its infancy, and lacks focus for the most part. We now have some useful information in the substantial number of positive correlations that have been found between various factors and the mathematical performance of black students. However, solutions to the persistent problem of under achievement have yet to be found.

To make progress on this front, researchers need to heed some recommendations of the Research Advisory Committee (RAC) of the National Council of Teachers of Mathematics (RAC, 1989). The committee recommends that researchers:

1. Develop useful conceptualizations of how minority (black in this case) students learn mathematics.
2. Enlarge current research efforts to focus in a systematic way on the mathematics learning of underrepresented and underserved groups.
3. Conduct school-based research that addresses teacher-minority student interactions, and how to change the classroom teaching and learning environment .

There are several useful conceptualizations like the ones called for in item #1, most notably a model by Reyes and Stanic (1988). These ideas have not had much impact on current research however. When they do, research will probably begin to yield the kind of information that will help make school mathematics work for African Americans and other underrepresented ethnic minorities.

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